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REVIEWS.

Elements of Geology, a Text-Book for Colleges and for the General Reader. By JOSEPH LE CONTE. Fourth edition, revised and enlarged, with new plates and illustrations. D. Appleton and Company. 1896.

The many excellences of this admirable text-book are too well known and too highly appreciated to need recital in detail. The author has endeavored to select those phases of geology which are most interesting to students and to general readers, and in this he has attained a rare success. In the interest of a clear exposition he has sought to eliminate unnecessary details, and at the same time to set forth the main grounds on which conclusions are drawn. An infallible judgment in so difficult a discrimination is not to be expected. Few who have made the attempt have succeeded better, on the whole, than has Dr. Le Conte. The style of presentation is easy, graceful and lucid. A philosophical tone pervades the book, and the student is never left long without a reminder of the intellectual processes by which conclusions are reached, or, at least, may be reached, for the reasoning, it must be remarked, savors somewhat more of the office than of the field, but the methods of the latter do not lend themselves equally well to easy and brief statement.

Somewhat more than half the book is occupied with dynamical and structural geology, and the rest with historical. The latter could probably be wisely extended at the expense of the former, and some of the dynamical and structural factors could perhaps be treated to advantage in a historical form. For the average student we think the history of the earth and the history of its typical features, treated causally, are more valuable than an analytical exposition of agencies and structures. Geology is essentially a science of the earth as an organism, and the biography of that organism is its most vital aspect as a factor in general education.

The special topics which have received fresh discussion in this revision of the work are earthquakes, the differentiation of rock mag-

mas, the Cambrian, the structure and affinities of trilobites, of Mesozoic reptiles, and of Mesozoic and Tertiary mammals, and the causes of glacial and other geological climates. Earthquakes are treated in a relatively elaborate way, which is perhaps warranted by the popular interest they awaken. They are, however, given more space than rivers, which have incomparably greater geological and educational importance. It would, we believe, have been better to bring the treatment of rivers and of topographic evolution well up to date even at the expense of a reduction of the space previously given to earthquakes, and to other less universal phenomena. The brief statement of magmatic differentiation, the greater emphasis placed on the Cambrian, and the later results of research on the trilobites, reptiles and mammals are all welcome additions. Much less, we fear, can be said in commendation of the discussion of glacial phenomena. The opening statement (p. 568) relative to the great oscillations of the earth's crust, and especially the unqualified assertion that "the glacial epoch is characterized by an *upward* movement of the crust in high-latitude regions, until the continents in those regions stood 1000 to 3000 feet above their present height," appears to the reviewer to need revision; at least, the student and the general reader should be informed that this once current doctrine has been cast aside by many of the most experienced glacialists on both sides of the Atlantic. That there was a very notable elevation in the *Pliocene* period is not doubted, indeed, among its strongest proofs are the very phenomena appealed to in proof of elevation in the glacial period. Unless the modern science of geomorphy goes for naught, the elevation that produced the fjords and the ragged borders of the northern coasts took place very much anterior to the glacial period. Concurrent with this evidence there has been gathered within the last few years a great mass of data which indicates that during much of the glacial period only a moderate—indeed, in part, a rather low—altitude prevailed. A conservative author may well be pardoned for not accepting these new doctrines, but scarcely for leaving students in total ignorance of them. A specific error of much significance is the statement, following Hilgard, that the Lafayette sands and gravels contain northern boulders, and their consequent reference to the glacial period. Crystalline pebbles, presumably of glacial origin, occur in the sands and gravels of the Natchez formation, which bears some resemblance to the Lafayette, because largely derived from it, and hence has

been confounded with it. The Natchez formation, however, lies unconformably on the Lafayette, as the writer has demonstrated. The contact shows that the Lafayette had acquired its peculiar ferrugination and partial induration and had been deeply eroded, before the Natchez formation was deposited. The latter holds pebbles of the brick-red, semi-indurated sand of the former in its unconformable layers at the contact. The Lafayette sands and gravels are wholly removed from genetic connection with the glacial series, and the inferences from their "torrential" character should be entirely dismissed. The extraordinary fact about the lower Mississippi valley is the *scantiness* of glaciö-fluvial deposits of a coarse nature.

The term Champlain is not unlike charity in its mantling function, and the pall of the latter is usually much needed in reviewing anything that goes under the caption of the former. Strictly applied to the marine deposits of the Champlain valley and their chronological equivalents, it serves a useful purpose, but when it is made to cover not only these, but the deposits of several different stages of the glacial epoch, its utility is of the inverted order. There is some slight mitigation of these "inherited blunders," to use the expressive phrase of Goode, in the work in hand, but only slight. The Champlain epoch is made to include the low altitude deposits without regard to how they may be sandwiched among the glacial stages. The result of this high-altitude, low-altitude mode of classification is a serious misconception of the real nature of the history of the glacial period.

The weakest points in the book are found in the treatment of the two ends of the geological column, the pre-Cambrian, which is very scantily treated, and the post-Pliocene which largely neglects the investigations of the last decade.

In the discussion of the antiquity of man in America, the doubtful nature of the evidences associated with the auriferous gravels of California are judiciously stated, but the more distant eastern relics are treated with less reserve. The Babbitt find at Little Falls, Minn., is cited as a "good example" of these, and perhaps it is a good example, as the canons of good science were quite ignored in giving it to the public, and the reference of the relics to the same age as the deposition of the beds in the superficial portion and in the talus of which they are found involves a palpable absurdity, as explicitly shown by Holmes. It would seem that students should be taught frankly that the evidence of Quaternary man in America is sharply challenged,

and that, until the trashy portion of the evidence is purged away and solid data are produced, no conclusions can safely be drawn.

These specific criticisms, which have required some little fullness of statement, give disproportion to this review, and it needs correction by a reaffirmation of the very high excellence of the work as a whole.

T. C. CHAMBERLIN.

The Oldest Fossiliferous Beds of the Amazon Region. By FRIEDERICH KATZER, chief of the geological section of the Pará Museum. Boletim do Museu Paraense, Vol. I, No. 4, pp. 436-438. Pará, Brazil, 1896.

It has already been satisfactorily shown that of the Palæozoic series we have in the Amazon valley rocks of Silurian, Devonian, and Carboniferous ages. Whether there is any Cambrian and Permian remains to be determined. The beds below the known Palæozoic rocks are gneisses, crystalline-schists, etc., referred to the Archæan. It is not impossible that some of the quartzites and mica-schists are Cambrian and Lower Silurian.

Upper Silurian beds have been recognized in the Amazon region thus far only at one place, mainly on the Rio Trombetas at Viramundo Falls, where fossils have been found.

In 1895, however, Dr. João Coelho made on the Rio Maecuru a rich collection which has been presented to the Pará Museum. After a careful examination of these rocks, graptolites have been found in them, thus proving the existence of Upper Silurian rocks in the Maecuru valley. This is the first discovery of these fossils in Brazil.

It is worthy of mention, also, that these graptolites were found in beds composed principally of siliceous spicules of sponges. These spicules are visible to the naked eye, but they are better seen with a lens magnifying ten to twenty diameters, or in thin microscopic sections. These sponge remains are the first of the kind found either in the Amazon region or in the Palæozoic beds of Brazil.

The author has recently presented a memoir on the geology of the Amazon, and especially on the Archæan rocks, to the Academy of Bohemia, based on his studies of a series of specimens from the zone north of Alemquer, and of another set brought by Dr. Goeldi from his scientific expedition to Guiana in 1895. In an early number of this Boletim he will give a résumé of that paper.